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JESSE H. JONES, Secretary

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LYMAN J. BRIGGS, Director

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**MAINTENANCE OF ELEVATOR
HOISTWAY AND CAR ENCLOSURES
AND EQUIPMENT**

By

Executive Committee for the American Standard Safety Code
for Elevators, Dumbwaiters, and Escalators

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PREFACE

Since three-quarters of all elevator accidents can be classified as originating at the hoistway openings, adequate protection of hoistway openings is the most effective way of reducing such accidents. Most elevators installed in the last twenty years have more or less complete hoistway enclosures and reasonably good protection of hoistway openings. However, unless such enclosures, doors, and door protective devices are properly maintained, they may create a false sense of security, resulting in serious accidents. The upkeep of such enclosures and protective devices is therefore of the greatest importance.

This Circular is the third of a series on elevator maintenance. The first, Elevator Wire Rope Maintenance, National Bureau of Standards Circular C441, and the second, Maintenance of Elevator Mechanical Safety Appliances, National Bureau of Standards Circular C442, may each be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., for 5 cents a copy. A similar circular dealing with the maintenance of hoisting machines and brakes is in preparation.

The preliminary draft of this Circular was prepared by J. A. Dickinson, Chief of the Bureau's Section of Safety Codes. The draft was reviewed and modified by the Executive Committee of the ASA Sectional Committee for a Safety Code for Elevators, Dumbwaiters, and Escalators, and also embodies comments of the Sectional Committee.

LYMAN J. BRIGGS, *Director*.

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ABSTRACT

This circular includes a brief discussion of elevator accidents, stressing the large percentage occurring at hoistway entrances, and then discusses in some detail the protective devices for hoistway doors and the methods of maintaining such devices in the best operating condition. Instructions on the care of floors at elevator entrances are given and the need for maintaining threshold illumination is stressed. The value of paint or other protective coatings on machine-room and hoistway walls is brought out.

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I. INTRODUCTION

In June 1941 the Sectional Committee for the American Standard Safety Code for Elevators, Dumbwaiters, and Escalators voted to discontinue work on the revision of that code for the duration. A supplement containing a few necessary modifications and all interim interpretations was issued in April 1942 in lieu of a revision.

By the time the annual meeting of the Sectional Committee was held in June 1942, it was evident that the acute shortage of repair and replacement parts would result in a marked decrease in elevator safety unless the utmost care was used in maintaining, as effectively as possible, such important items as wire rope, undercar safeties, and their associated mechanisms, interlocks, hoisting engines, etc. The Sectional Committee therefore suggested that the Executive Committee prepare a series of service bulletins covering such equipment.

There is an old proverb that "A stitch in time saves nine." Periodic inspection, with the tightening of loose parts, correction of misalignment, and prompt attention to slightly worn equipment should decrease the possibility of serious accident, and result in the maximum obtainable use of the equipment. Further, such maintenance should materially decrease the number of minor service interruptions and increase the periods between major overhauls.

The Inspectors' Manual¹ prepared by the Sectional Committee for the Safety Code for Elevators, Dumbwaiters, and Escalators covers in considerable detail the methods of inspecting elevator equipment. Occasional references to the Manual may be found in this publication.

As these bulletins are not intended for legal adoption or enforcement they have not been given the status of an American Standards Association project but have been prepared quite informally by the Executive Committee as its contribution toward elevator safety during the emergency.

Adequate maintenance service will do much to prolong the life of elevator equipment, and somewhat greater expenditure for this purpose will pay handsome dividends, particularly during the present emergency when repair and replacement parts are at a premium.

It is the hope of the Executive Committee that these bulletins may be of value to owners of elevators, and that they may, by calling attention to certain work that should be done and certain precautions that should be taken, be a means of maintaining the excellent safety record made by vertical transportation during the last two decades.

II. HOISTWAY ENCLOSURES AND PROTECTION

1. CAUSES OF HOISTWAY-DOOR ACCIDENTS

1. A falling car is popularly considered to be the greatest of elevator hazards. Although spectacular, such accidents actually result in only a small percentage of the serious or fatal injuries. At least 75 percent of all elevator accidents occur at the hoistway door. These are due to: (a) tripping or slipping at the car entrance, (b) being caught by car, (c) falling down the hoistway, and (d) being struck or caught by door.

¹ The Manual may be obtained from the American Society of Mechanical Engineers, 29 West 39th Street, New York, N. Y., for 75 cents a copy.

(a) TRIPPING HAZARD

2. Tripping or slipping is generally due to:

Difference of level of car and sill.

Poor condition of floor surface at landing or car entrance.

Insufficient illumination of threshold.

Excessive clearance between car and sill.

(1) *Differences of Level.*

3. Differences of level may be due to unskillful operation or, particularly in the case of self-leveling elevators, to poor adjustment. Many tripping accidents occur even when the difference of level is less than 2 inches.

(2) *Correction of Bad Leveling.*

4. Circular C441 points out that "inching" at landings shortens rope life. Out-of-level landings set up a tripping hazard. Operators should be trained to make accurate stops. On elevators not equipped with automatic leveling, controllers and brakes must be kept in proper adjustment to enable the operator to make accurate stops. Self-leveling equipment must be kept in adjustment as the operator in such installations has no control of the final stop. These adjustments must be made by a competent mechanic; preferably an employee of the company which made the original installation.

(3) *Slipping Due to Floor Conditions.*

5. Many elevator safety codes require the landing sill to be of non-slip material. Sills, worn smooth, should be replaced or the surface may be roughened. Broken sills should be repaired or replaced.

(4) *Tripping Due to Floor Conditions.*

6. Holes in car flooring and badly worn coverings are serious tripping hazards. When repairing or replacing flooring or floor covering, the finished floor should present a continuous flush surface.

7. Excessive clearance between car and sill should be eliminated.

8. Difference in level between the landing and car sill and adjacent flooring should be eliminated.

(5) *Threshold Illumination.*

9. A minimum illumination of 2 foot-candles is desirable on the threshold at elevator entrances. A 100-watt, metallic-filament lamp placed 8 feet 3 inches above the landing edge of the car platform should give approximately this illumination. When elevators are located close to building entrances, values of illumination should be considerably higher, as a person's eyes, adjusted to outdoor sunlight, do not rapidly readjust for low intensities. Luminaires and lamps should be cleaned periodically and blackened or old lamps replaced with lamps of proper wattage and voltage rating.

(b) HOISTWAY-DOOR ACCIDENTS

(1) *Difference Between Interlock and Contact.*

10. There is misunderstanding as to the difference between hoistway-door interlock and a hoistway-door contact. An interlock prevents the motion of the car (except for leveling) when the door is

opened or unlocked as the interlock contact cannot be established before the door is closed and locked. A contact prevents the operation of the car when the door is open, and a door latch prevents the opening of the door from the landing side when locked, but this combination cannot insure the locking of the door before the car leaves the landing.

(2) *Protection Afforded by Interlocks and Contacts.*

11. Properly constructed and maintained hoistway-door interlocks will greatly reduce the number of hoistway-door accidents. The use of hoistway-door contacts alone will reduce the number of door accidents but still allows the door to be opened with the car away from the floor, permitting a person to fall down the hoistway. The use of door interlocks rather than door contacts and independent locks is recommended.

2. INTERLOCK INSPECTION

(a) SETTING OF SWITCHES

12. The position of the door at which the contact is made should be checked at least once a year. This is done by closing the door slowly and, as the car starts, measuring from the landing side the clear opening between the edge of the door and the nearest face of the jamb. This test should be made while operating the car at the lowest possible speed. Sequence relays, where used, should be by-passed during this test. If the contact is made before the door reaches full closure, the interlock must prevent the door being reopened more than 4 inches. The contact must be made only within this range.

(b) INSPECTION OF SWITCH PARTS

13. The interlock contacts should be inspected at least twice a year. Contacts that are pitted or burned should be cleaned or replaced. Wires should be checked to see that they are not loose and that the bare portions of wires are well separated from each other and from grounded metal parts. Interlocks should be protected against grounds or short-circuits due to water used for washing the landings or platforms. Such water usually contains salts or acids which may readily break down insulating material.

(c) ALINEMENT OF LOCKING PARTS

14. The fastenings which hold the switch box to the hoistway enclosure or door buck should be checked for tightness. Where locking members enter the switch box, check its alinement with the opening in the box and, if necessary, correct any misalinement.

(d) ALINEMENT OF SWITCH PARTS

15. Current-carrying parts should be in alinement *when the hoistway door is fully closed*. Do not try to check alinement of parts when door is partly open, as many types of switches are purposely made with sliding or wiping contacts which reach final alinement only when the door is fully closed.

(e) INSPECTION OF DOOR-LOCKING MECHANISM

16. Door-locking mechanism should be checked to see that the door is properly locked when the car is not at the landing. With some

locking mechanisms the wear of pins may permit the locking member to be displaced, allowing the opening of the door from the landing side. Where the bottom of the door can be displaced more than $\frac{1}{4}$ inch due to wear, the guide pins or bars should be replaced, or the slot in the landing sill relined.

(f) INSPECTION OF DOOR CLOSERS

17. Door-closer arms should be examined for lost motion. Where excessive lost motion is encountered, correction should be made by a qualified mechanic. Hydraulic door checks should be examined to see that they contain the proper amount of fluid and that proper cushioning action is provided. If necessary to add fluid, be sure it is of the same quality and viscosity as that recommended by the manufacturer. Check all fastenings to doors, door bucks, and sills for loose or missing screws or bolts, tightening or replacing, if necessary. Check broken-arm closers to see that the toggle bar is in the locked position.

3. HOISTWAY-DOOR CONTACT INSPECTION

18. Hoistway-door contacts should receive the same inspection and maintenance as is recommended for the interlock-switch mechanism.

4. HOISTWAY-DOOR LATCHES

19. Hoistway-door latches wear and, when worn, may permit the door to be opened from the landing side. When the door is shut rapidly a worn latch may permit the door to rebound to a point beyond the locking range and the door be left unlatched, permitting destructive arcing of the contact surfaces.

5. MAINTENANCE OF DOOR HARDWARE, INTERLOCKS, AND CLOSERS

20. Frequent cleaning and use of proper lubricant on door hangers and tracks will aid in reducing the fatigue of personnel and prolonging the life of equipment. Interlock mechanism and door-closer parts should be properly lubricated, but excess oil should be wiped off.

III. HOISTWAY DOORS AND GATES

1. HORIZONTALLY SLIDING DOORS

21. Examine horizontally sliding doors for alinement, broken or defective panels, defective latches (see par. 19), interlocks, or contacts (see par. 12 to 16 and 18). Bent door sections should be straightened or replaced. Loose or damaged panels should be repaired or replaced. Examine door hangers for wear or lost motion. Be sure the door cannot be displaced from its guides. Correct defective conditions. See that glass vision panel is intact and held securely (see par. 25).

(a) CLEANING OF DOOR GROOVES

22. Both hoistway- and car-door track grooves should be kept clean and free from foreign material. Dirt-escape slots aid in keeping grooves clean and are recommended where practical. They should be at least $2\frac{1}{2}$ inches long, being located in front of the guide pins when the door is in the fully opened and closed positions.

2. VERTICALLY RISING GATES

23. Vertically rising gates should be examined for alinement, worn suspension ropes, worn or badly alined sheaves, worn guides, and to determine that gate counterweights operate freely and are enclosed.

3. VERTICALLY SLIDING, BIPARTING DOORS

24. Examine vertically sliding, biparting doors for alinement, worn suspension chains, worn or badly alined sheaves, worn guides and guide shoes, loose guides, broken or defective latches and interlocks (see par. 12 to 16). Check doors for free operation. Bent door sections should be straightened or replaced. Loose or damaged panels should be repaired or replaced. Adjust door stops, if necessary, so that the open door will be level with the sill. See that the vision panel glass is intact and securely fastened (see par. 25).

4. REPLACEMENT OF VISION PANELS

25. If the glass in a vision panel is broken, the elevator must not be run until the glass is replaced or the opening covered temporarily. When replacing glass it is recommended that, where necessary, the clear opening be reduced by the insertion of intermediate bars, or muntins, so that it will reject a 6-inch-diameter sphere.

IV. HOISTWAY ENCLOSURES

1. INSPECTION

26. Examine hoistway enclosures to be sure that they are firmly fastened to building members. Broken, defective, or loose panels should be replaced or repaired. Where codes require covering over grillwork, see that such material is installed and is securely fastened, either to the grillwork or to supporting structural members. Hoistway- and machine-room enclosures should be inspected for loose plaster or mortar, which, when found, should be removed and the wall replastered or repointed.

2. CLEANING AND PAINTING

27. Periodic cleaning of machine rooms, top and bottom of cars, and hoistway walls and pits will improve the operating conditions and also reduce fire hazard and wear of equipment. It will also decrease the possibility of serious fires, with the resulting loss of service of equipment and extensive replacement of critical materials. Elevator pits should be kept clean and dry; they should never be used for the storage of materials. The painting or treatment of concrete floors and unplastered walls in machine rooms with sodium silicate (water glass) or similar compounds will decrease the amount of dust and grit which might otherwise find its way onto relay and contactor surfaces and into machine bearings. Such painting or treatment should decrease minor service interruptions. The painting or treatment of unplastered hoistway walls will seal in loose particles of sand and mortar, thus preventing this material from reaching the guide rails, shoes, undercar safeties, and buffers.

V. CAR AND CAR EQUIPMENT

1. CAR INSPECTION

(a) ENCLOSURES

28. See that the car enclosure is securely fastened to the platform and that bolts, screws, and other fastenings are tight. If, after tightening the fastenings, the car enclosure can be deflected far enough by a person leaning against it or by freight in contact with it to cause the cab to strike an obstruction in the hoistway, additional stiffening must be provided.

(b) EMERGENCY EXITS

29. Side exits should be tested by opening them. Where panels are held in place with locks, the key should be in the car. For automatic-operation elevators, the key should be in charge of the person who will answer the alarm bell.

30. Top emergency exits should be closed when a car is in service. Serious injury to passengers has resulted from objects which have fallen down the hoistway and entered the car through open emergency exits. Check to see that they may be opened from within the car. Where hinges are not provided, see that the exit cover is secured by a rope or chain to prevent it from falling down the hoistway.

(c) EMERGENCY-EXIT FASTENINGS

31. Where thumbscrew fastenings are used, all thumbscrews should be in place and should be operable without the use of pliers or a wrench. If thumbscrews cannot be turned by hand, they should be freed and thoroughly lubricated and when the panel is replaced the thumbscrews should be tightened by hand only. Both top and side emergency exits should be operable from the outside of the car.

(d) CAR DOORS

32. Car doors should be subjected to the same inspection as hoistway doors, and the same corrective measures taken (see par. 20 to 22).

(e) CAR GATES

33. Car gates should be examined for excessive wear. If wear is excessive, the gate should be repaired or replaced. Where gates of the pantograph type are power-opened, the protective curtains should be examined to see that they are operating properly. Damaged or defective curtains should be repaired or replaced. Excessively worn bottom guides and badly worn rollers or track should be replaced.

(1) *Car-Gate Contacts.*

34. Car-gate contacts should receive the same inspection as is given to hoistway-door contacts (see par. 18). Be sure that the contact is opened mechanically as the gate is opened.

(f) CAR-OPERATING PANEL

35. Examine car-operating panel and operate all devices thereon, including emergency stop, by-pass switches, motor-generator switch

and pilot light, leveling and car light switches to see that they are functioning properly. Check car switch for return to, and latching in, the neutral position. See that emergency-release glass covers are in place, and that alarm bell and telephone are functioning. Adjust or replace any device not operating properly. All switch contacts in the car panel should be examined annually and defective contacts replaced.

(g) CAR-LIGHTING FIXTURE

36. Examine lighting fixture for missing glass-holding screws. Replace missing screws and any broken or cracked glassware. Glass breakage and accidents may be prevented by backing off glass-holding screws about one-half turn after they have contacted the glassware. Clean the glassware and replace burned-out lamp bulbs.

VI. SIGNAL SYSTEMS

37. Signal systems should be checked for loose or worn contacts, loose connections, and misalignment of parts. See that junction and outlet boxes and their cover plates are securely fastened. Replace burned-out bulbs. The use of a low-voltage supply will increase lamp life. Where transformers that have a number of taps have been provided to supply the signal circuit, use the lowest voltage that will give clear illumination to the indicator.

WASHINGTON, February 16, 1943.



